Tracking Footprints through a Medical Information Space
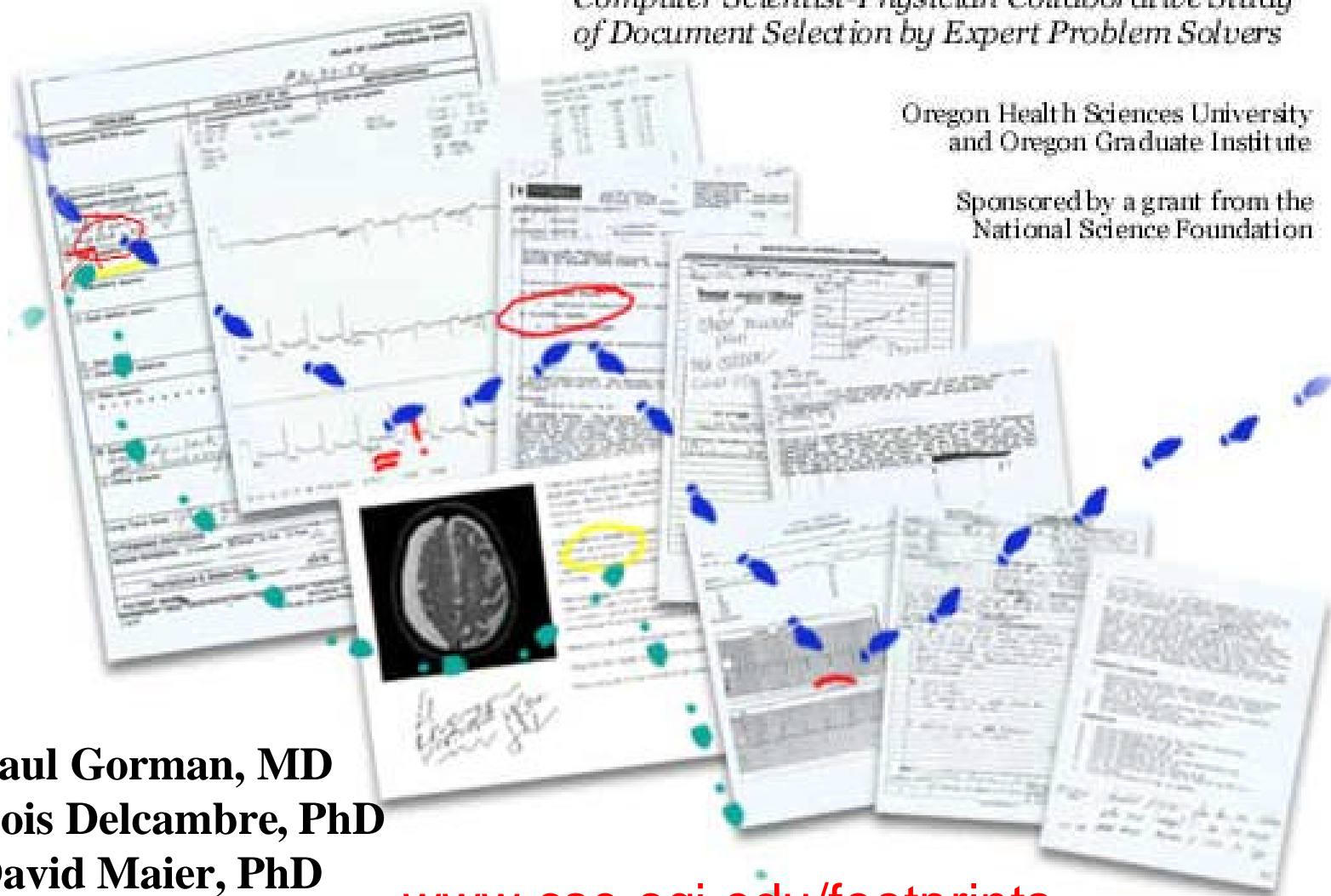
Computer Scientist-Physician Collaborative Study
of Document Selection by Expert Problem Solvers

Oregon Health Sciences University
and Oregon Graduate Institute

Sponsored by a grant from the
National Science Foundation

Paul Gorman, MD
Lois Delcambre, PhD
David Maier, PhD

www.cse.ogi.edu/footprints

Bundles in the wild………..

Observational team:

Paul Gorman
Joan Ash
Mary Lavelle
Jason Lyman

Oregon Health Sciences University

…………..Bundles in captivity

Computer science team:

Lois Delcambre
Dave Maier
Shawn Bowers
Mathew Weaver

Rupa Tummala

Sun Murthy

Oregon Graduate Institute of Science & Technology
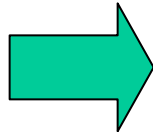
Oregon Health Sciences University
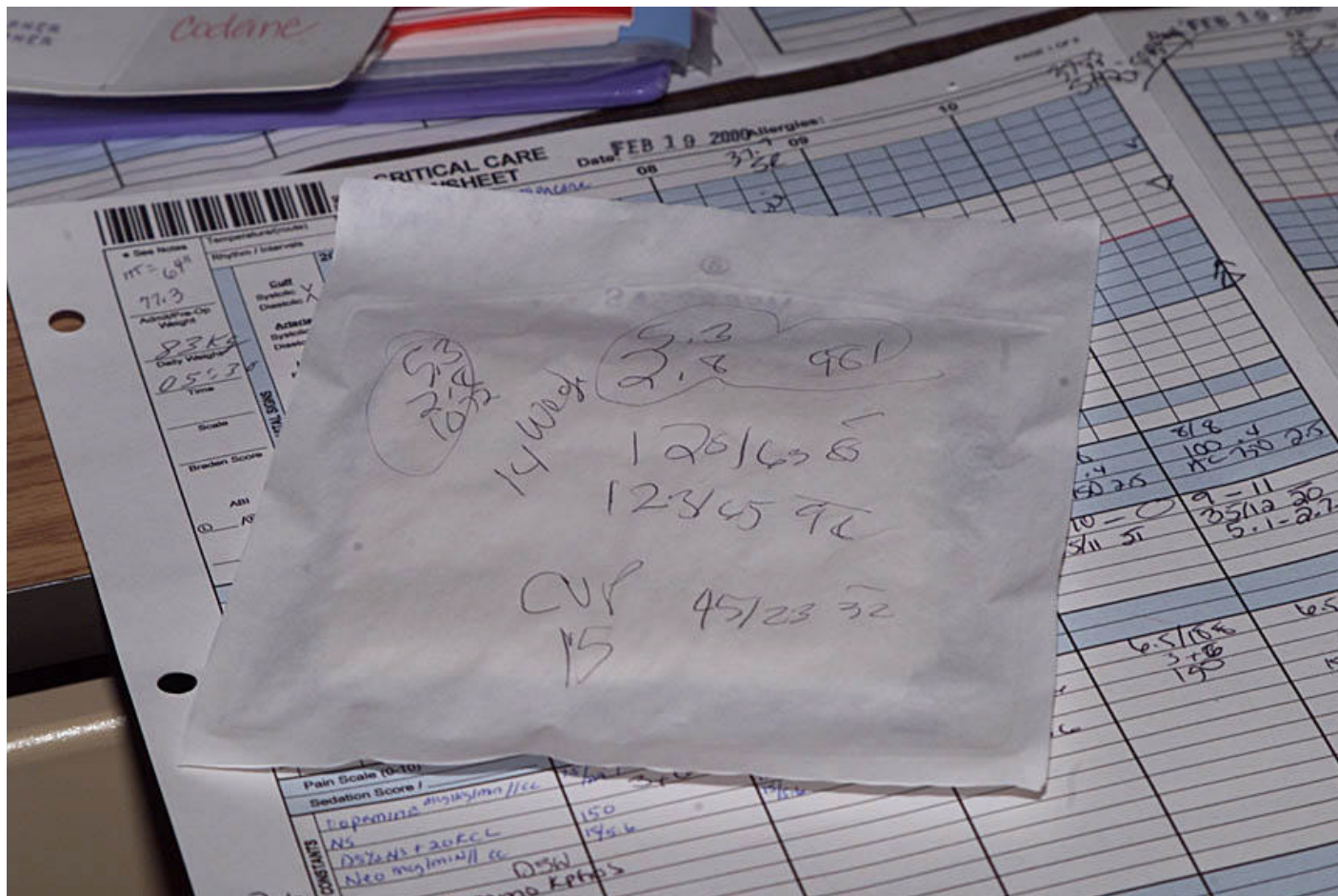
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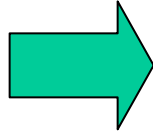
Oregon Health and Sciences University

Oregon Graduate Institute

→

School of Science & Engineering

Merging on July 1, 2001

(Wild) Bundles

(Wild) Bundles

- There is benefit in creating (active processing of information)

- There is benefit in reusing (trigger memory)

- There is benefit in sharing (establish collective, situated awareness)

Bundles in the Wild: Managing Information to Solve Problems and Maintain Situation Awareness

Library Trends, 2000, Volume 49, Number 2

Paul Gorman, Joan Ash, Mary Lavelle, Jason Lyman, Lois Delcambre, David Maier

Division of Medical Informatics and Outcomes Research
Oregon Health Sciences University

Database and Object Technology Lab
Computer Science and Engineering Department
Oregon Graduate Institute

Bundles: Meeting Clinical Information Needs

Bulletin of the Medical Library Association

2001 (in press)

Joan Ash, Paul Gorman, Mary Lavelle, Jason Lyman,

Lois Delcambre, David Maier

Division of Medical Informatics and Outcomes Research
Oregon Health Sciences University

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Computer Science and Engineering Department
Oregon Graduate Institute

Following Experts at Work in Their Own Information Spaces: Using Observational Methods to Develop Tools for the Digital Library

Submitted to the Journal of the American Society of Information Science and Technology 2001

Paul Gorman, Mary Lavelle, Lois Delcambre, and David Maier

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Oregon Health Sciences University

Database and Object Technology Lab
Computer Science and Engineering Department
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Given….

- bundles are everywhere!
- access to bundles provides access to important information
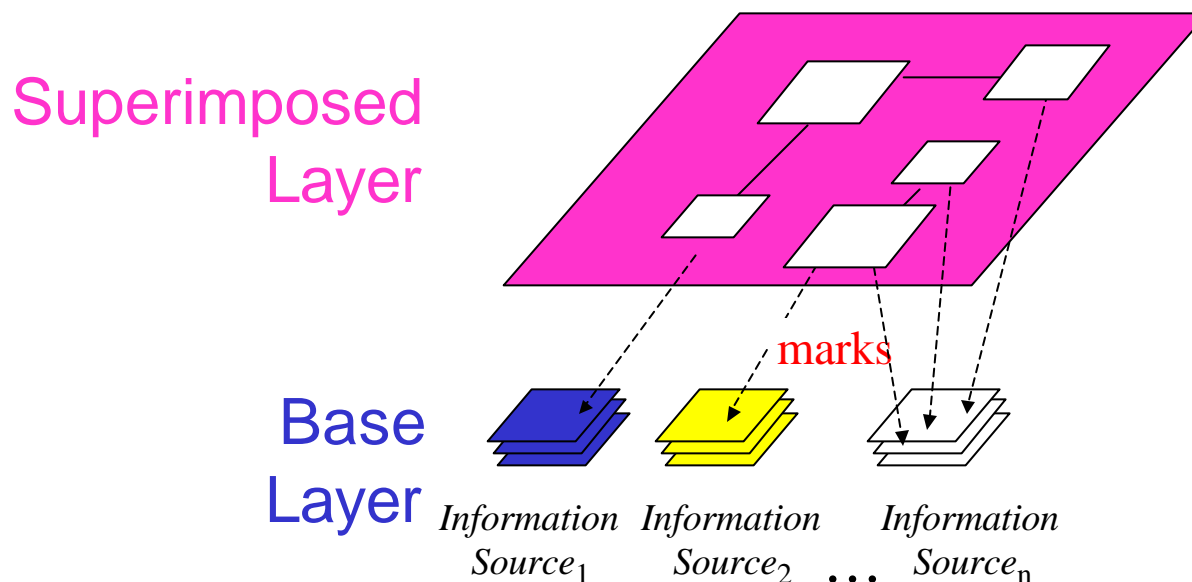- information in bundles is often copied from other information sources

We can create bundles in a superimposed application.

We can keep referenced information linked through the use of marks

Bundles are superimposed information

? Superimposed information:

- highlights
- annotates
- elaborates
- selects
- collects
- organizes
- connects
- reuses
- information elements

Superimposed
Layer

marks

Base
Layer

Information Source$_1$ *Information Source$_2$*   ...   *Information Source$_n$*

Focus on building generic technology

Resident's Worksheet

SLIMPad

Superimposed Information Management

Superimposed Application

Application Data

Application Specific API

Generic Management

TRIM Store

Mark Management

A general architecture for building superimposed applications

Bundles in Captivity: An Application of Superimposed Information

International Conference on Data Engineering
ICDE 2001
Heidelberg, Germany

Lois Delcambre, David Maier, Shawn Bowers, Mathew Weaver, Longxing Deng,
Paul Gorman, Joan Ash, Mary Lavelle, Jason Lyman

Database and Object Technology Lab
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Oregon Graduate Institute

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Oregon Health Sciences University

Representing and Transforming Model-based Information

Semantic Web Workshop
held in conjunction with the
European Conference on Digital Libraries
Lisbon, Portugal

Shawn Bowers and Lois Delcambre
Computer Science Department
Oregon Graduate Institute

Invited for submission to a journal

Uni-level Description of Computer Information

Patent Application: April 2001

Lois Delcambre and Shawn Bowers

A patent describing the generic representation
and the transformation techniques

presented in the Semantic Web Workshop

What's the point?

1. Information seeking is secondary (problem solving/patient care is primary).

2. Expert problem solvers are implicitly making information selections as they work.

We set out to "reuse human attention" …

We set out to explore superimposed information and superimposed applications.

Results

1. Use of bundles is ubiquitous.

2. Sharing/reusing bundles is of high benefit.

3. Superimposed applications can be built from generic components.

4. Easily "clicking through" to the underlying context is of high benefit.

Serendipitous Results

1. Free-form nature of SLIMPad/bundle/scrap model captures human expertise (much like Google mines human expertise – the links placed by humans).

2. SLIMPad does not understand the human expertise … implicit in the SLIMPad content.

3. Such work appears in a broad range of applications.

4. We are extending SLIMPad.

5. We are exploring and validating these findings in a specific medical application.

Current Investigation: Can SLIMPad Help a Real Task?

- **Task**: Hospital Discharge Summary
  - Brief summary dictated & transcribed at discharge
  - Flexible content/Standard structure
  - Chore to create/Highly valued once created
- **Problem**: MDs complain about new system
  - Like distributed access to (scanned) record, but
  - Much more difficult to do discharge summary
  - Overwhelming impetus to make everything digital
- **Data**: Invite MDs to be videotaped doing work
  - First two respondents: Dr. M and Dr. P

Dr. M. Discharge Summary: Paper Hospital Record

QuickTime™ and a
Photo - JPEG decompressor
are needed to see this picture.

Tools Available

- Telephone

- Paper hospital record

- Outline reminder

- Personal notes

- PC (not used)

Time Elapsed

- 4 min 31 sec

Dr. P. Discharge Summary: Electronic Hospital Record

QuickTime™ and a
Photo - JPEG decompressor
are needed to see this picture.

Tools Available

- Telephone

- PC # 1: scanned paper record system

- PC # 2: legacy system w/ labs, transcribed rpts

- Blank sheet of paper

Time Elapsed

- 19 min 16 sec

Scanned Hospital Record

8/19/00

R₁   TS4 PN

S/ Mrs. _____ reports feeling pretty good this morning. Is worried about not eating before her thallium scan. No CP, has not had any pain for 24 hours

O/ VS: BP 104-150/56-100   HR 62-136   RR 16-20
    I/O 2160/1525   Net +635   Weight 65.8 ← 64.1

General: NAD, does not look anxious
HEENT: OP moist + benign
Neck: Ø JVD
Chest: Clear to auscultation, few crackles R > L base
CV: Irreg. Irreg., rate regular
Abdomen: NABS, protuberant, soft
Extremities: Trace edema LE's Ⓑ

Meds:
Allopurinol 200'
Amiodarone load
Elavil 10 QAm, 20 QPm
ASA
Cipro 250²
Dig load
Famotidine 5'
Heparin 5000 sc

Labs: ⑪/89/45   Ca 8.1
3.0/28/15   ⑥2   8.1 / A8 / 37.7

Dueling Residents

QuickTime™ and a
Photo - JPEG decompressor
are needed to see this picture.

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Photo - JPEG decompressor
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Observations

- Observations
  - Much faster with paper record
  - MD creates bundle as part of task
  - Selection, organization, and annotation
  - Information from disparate sources

- Questions
  1. Will tool that enables bundle creation (SLIMPad) help MDs perform discharge summary task?
  2. What if MD were able to create and maintain bundle throughout hospital stay?

Fertile Ground

- ## Boeing Service Engineering
  - Collaborative Knowledge Management
- ## Oregon Clinic Cardiologists
  - Saturday rounds "handover"
- ## Intel Corporation
  - Consumer Health Information
- ## NASA Johnson Space Center
  - Anomoly response, ? Other applications
- ## Forest Service Digital Government Project
  - Watershed assessment

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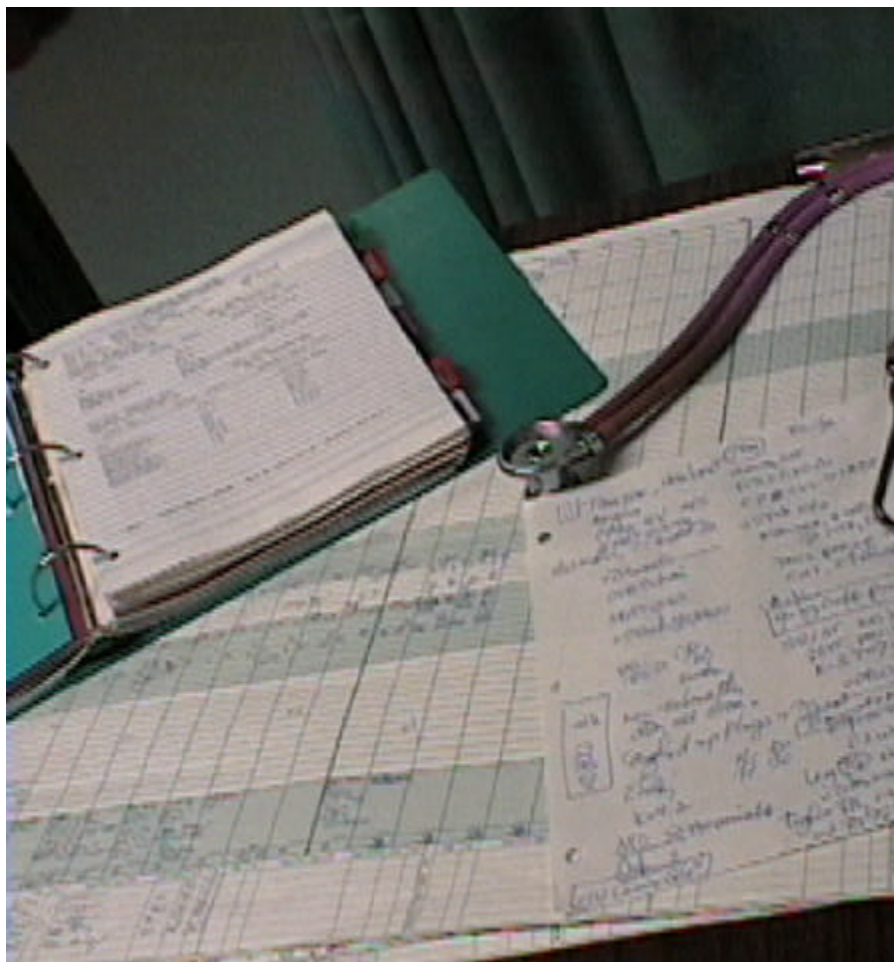
Annotation

Resident's Worksheet

- Most information found elsewhere (not all)
- Info from many patients
- Predictable structure, flexible content
- Organic, working document
- Assembled and reused by resident
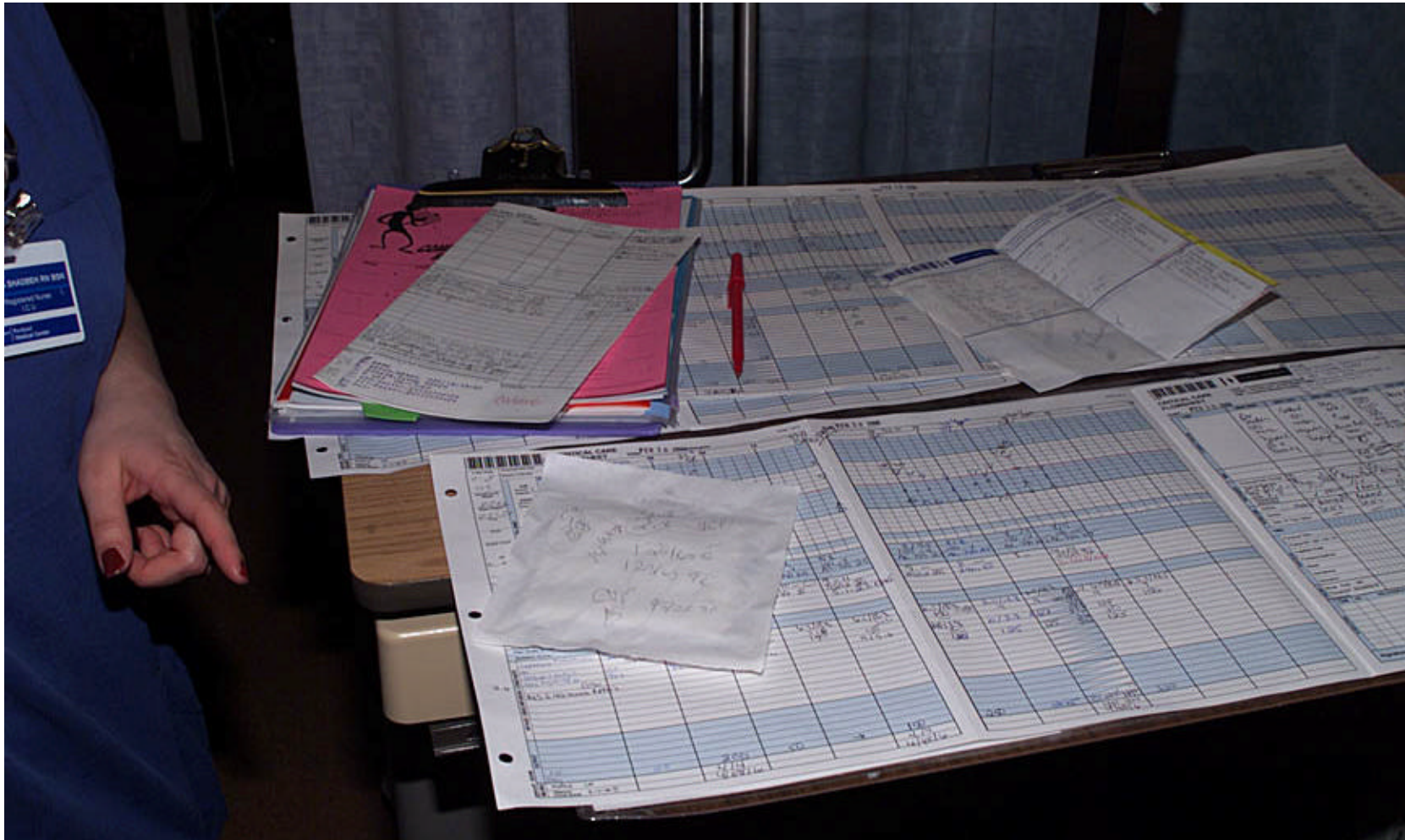- Portable, temporary, task-oriented

Messy Bundles
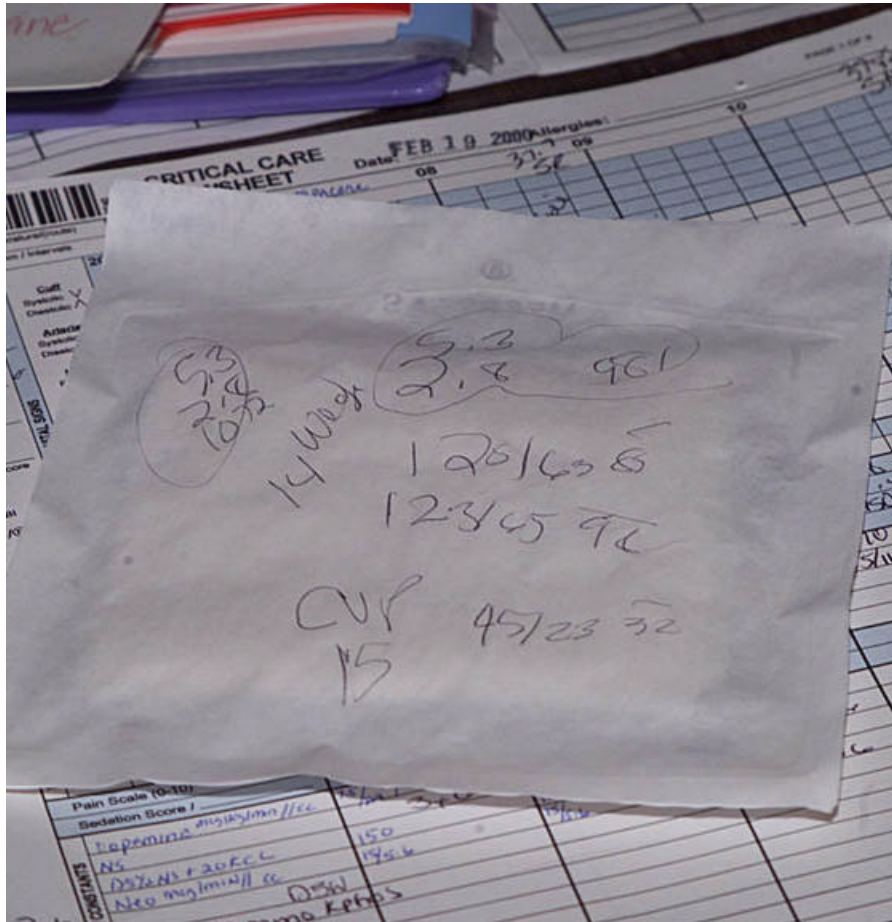
- Extremely flexible entry, display, content
- Meaningful organization and annotation
- High signal-to-noise
- Portability, immediacy, integration w/ pt care
- Recording benefit to situation awareness
- Physical location meaningful (reminding)

The Flow Sheet

- Working document, permanent record
- Present and recent past states of patient
- Information exists elsewhere (eventually)
- Highly structured, still flexible content
- Selection, organization, annotation by nurse
- Used by everyone

Bundle of Bundles

Use of Flightstrips in French Air Traffic Control

Information Seeking in Healthcare

Gathering Patient
Data in Clinic

Finding Medical
Knowledge

Patient Care in ICU

What information consumes is attention…

A wealth of information produces a poverty of attention

Herbert Simon

Beyond the ICU:
Are Bundles Unique to Health Care?